What is claimed is:

1. An imaging device comprising:

a plurality of pixel elements, each pixel element including complementary first-type and second-type modulation doped quantum well interfaces that are formed in a resonant cavity on a substrate and that are spaced apart from one another, wherein electromagnetic radiation within a predetermined wavelength range is received at said pixel element and injected into said resonant cavity thereby generating charge that is accumulated in said second-type modulation doped quantum well interface for said pixel element.

2. An imaging device according to claim 1, wherein:

the amount of charge accumulated in said second-type modulation doped quantum well interface for said pixel element is proportional to power of the electromagnetic radiation within the predetermined wavelength range that is received at said pixel element.

3. An imaging device according to claim 1, wherein:

the electromagnetic radiation within the predetermined wavelength range increases electron temperature of a two-dimensional electron gas at said first-type modulation doped quantum well interface thereby producing a current resulting from thermionic emission over a potential barrier provided by said first-type modulation doped quantum well interface, wherein said current results in accumulation of charge in said second-type modulation doped quantum well interface.

4. An imaging device according to claim 3, wherein:

said current is proportional to power of the electromagnetic radiation within the predetermined wavelength range that is received at the pixel element.

5. An imaging device according to claim 1, wherein:

said first-type modulation doped quantum well interface and said second-type modulation doped quantum well interface are spaced apart from one another in a vertical dimension.

6. An imaging device according to claim 1, wherein:

each pixel element is adapted to operate in at least one of the following modes:

i) a pixel setup mode whereby charge is emptied from said second-type modulation doped quantum well interface for said pixel element;

ii) a signal integration mode whereby charge is accumulated in said second-type modulation doped quantum well interface over an integration time period; and

iii) a signal transfer mode whereby charge is read out from said second-type modulation doped quantum well interface.

7. An imaging device according to claim 6, wherein:

each pixel element is adapted to perform a sequence of imaging cycles, each cycle including said pixel setup mode, said signal integration mode, and said signal transfer mode.

8. An imaging device according to claim 6, wherein:

free charge is emptied from said first-type modulation doped quantum well interface during said signal transfer mode.

9. An imaging device according to claim 6, wherein:

charge is transferred between pixel elements in said signal transfer mode to thereby realize a CCD-type imaging array.

10. An imaging device according to claim 9, wherein:

charge is transferred between pixel elements over a pathway defined by a second-type modulation doped interface between pixel elements.

11. An imaging device according to claim 10, wherein:

said second-type modulation doped interface between pixel elements is doped with donor ions to increase carrier density.

12. An imaging device according to claim 10, wherein:

length of said second-type modulation doped interface between pixel elements is selected for desired charge velocity between pixel elements.

13. An imaging device according to claim 1, wherein:

each pixel element includes an undoped spacer layer disposed between said first-type modulation doped quantum well interface and said second-type modulation doped quantum well interface.

14. An imaging device according to claim 13, wherein:

each pixel element includes

at least one first-type ion implant in electrical contact with said first-type modulation doped quantum well interface, and

second-type ions implants in electrical contact with said second-type modulation doped quantum well interface.

15. An imaging device according to claim 14, wherein:

each pixel element includes

at least one first channel injector terminal formed from a metal layer deposited on said at least one first-type ion implant, and

second channel injector terminals formed from a metal layer deposited on said second-type ion implants.

16. An imaging device according to claim 15, wherein:

each pixel element includes

an anode and cathode formed such that said first-type modulation doped quantum well interface and said second-type modulation doped quantum well interface are disposed between said anode and said cathode,

an anode terminal electrically coupled to said anode, and

a cathode terminal electrically coupled to said cathode to thereby integrally forming a thyristor-based pixel element on said substrate.

17. An imaging device according to claim 16, further comprising:

circuitry, electrically coupled to a second channel injector for a given pixel element in a pixel setup mode, that empties free charge from said second-type modulation doped quantum well interface for said given pixel element in said pixel setup mode.

18. An imaging device according to claim 16, wherein:

said second-type modulation doped quantum well interface for each pixel element includes a potential barrier portion and a charge storage portion, said charge storage portion formed via a threshold-adjusting ion implant therein, said potential barrier portion disposed under said anode terminal and providing a voltage-controlled potential barrier.

19. An imaging device according to claim 18, wherein:

circuitry, electrically coupled to the anode terminals for said pixel elements, that applies clock pulses to said anode terminals to transfer charge between adjacent pixel elements utilizing voltage-controlled adjustment of said potential barrier provided by said potential barrier portion of said pixel elements.

20. An imaging device according to claim 16, further comprising:

circuitry, electrically coupled to a first channel injector terminal for a given pixel element in a signal transfer mode, that empties free charge from said first-type modulation doped quantum well interface for said given pixel element in said signal transfer mode.

21. An imaging device according to claim 16, further comprising:

electronic shutter circuitry, electrically coupled to said cathode terminal for a given pixel element, that selectively operates to couple said cathode terminal to a load element or place said cathode terminal in a high-impedance state.

22. An imaging device according to claim 21, wherein:

said electronic shutter circuitry couples said cathode terminal for the given pixel element to a load element during a signal integration mode whereby charge is accumulated in said second-type modulation doped quantum well interface for the given pixel element.

23. An imaging device according to claim 21, wherein:

said electronic shutter circuitry places said cathode terminal for the given pixel element in a high-impedance state during at least one of

a pixel setup mode whereby charge is emptied from said second-type modulation doped quantum well interface for the given pixel element, and

a signal transfer mode whereby charge is read out from said second-type modulation doped quantum well interface for the given pixel element.

24. An imaging device according to claim 1, wherein:

said plurality of pixel elements are part of a full-frame-type imaging array.

25. An imaging device according to claim 1, wherein:

said plurality of pixel elements are part of an interline-type imaging array.

26. An imaging device according to claim 1, wherein:

said plurality of pixel elements are part of an active-pixel-type imaging array.

27. A method of generating an image of received electromagnetic radiation within a predetermined wavelength range comprising:

providing a plurality of pixel elements, each pixel element including complementary first-type and second-type modulation doped quantum well interfaces that are formed in a resonant cavity on a substrate and that are spaced apart from one another, wherein electromagnetic radiation within the predetermined wavelength range is received at said pixel element and injected into said resonant cavity;

adapting said pixel elements to operate in a signal integration mode whereby charge is accumulated in said second-type modulation doped quantum well interface of said pixel elements over an integration time period.

28. A method according to claim 27, wherein:

the amount of charge accumulated in said second-type modulation doped quantum well interface for said pixel element is proportional to power of the electromagnetic radiation within the predetermined wavelength range that is received at said pixel element.

29. A method according to claim 27, wherein:

the electromagnetic radiation within the predetermined wavelength range increases electron temperature of a two-dimensional electron gas at said first-type modulation doped quantum well interface thereby producing a current resulting from thermionic emission over a potential barrier provided by said first-type modulation doped quantum well interface, wherein said current results in accumulation of charge in said second-type modulation doped quantum well interface.

30. A method according to claim 29, wherein:

said current is proportional to power of the electromagnetic radiation within the predetermined wavelength range that is received at the pixel element.

31. A method according to claim 27, wherein:

said first-type modulation doped quantum well interface and said second-type modulation doped quantum well interface are spaced apart from one another in a vertical dimension.

32. A method according to claim 27, wherein:

each pixel element is adapted to operate in at least one of the following modes:

i) a pixel setup mode whereby charge is emptied from said second-type modulation doped quantum well interface for said pixel element; and

ii) a signal transfer mode whereby charge is read out from said second-type modulation doped quantum well interface.

33. A method according to claim 32, wherein:

each pixel element is adapted to perform a sequence of imaging cycles, each cycle including said pixel setup mode, said signal integration mode, and said signal transfer mode.

34. A method according to claim 32, wherein:

free charge is emptied from said first-type modulation doped quantum well interface during said signal transfer mode.

35. A method according to claim 32, wherein:

charge is transferred between pixel elements in said signal transfer mode to thereby perform CCD-type imaging operations.

36. A method according to claim 35, wherein:

charge is transferred between pixel elements over a pathway defined by a second-type modulation doped interface between pixel elements.

37. A method according to claim 36, wherein:

said second-type modulation doped interface between pixel elements is doped with donor ions to increase carrier density.

38. A method according to claim 36, wherein:

length of said second-type modulation doped interface between pixel elements is selected for desired charge velocity between pixel elements.

39. A method according to claim 27, wherein:

each pixel element includes an undoped spacer layer disposed between said first-type modulation doped quantum well interface and said second-type modulation doped quantum well interface.

40. A method according to claim 39, wherein:

each pixel element includes

at least one first-type ion implant in electrical contact with said first-type modulation doped quantum well interface, and

second-type ions implants in electrical contact with said second-type modulation doped quantum well interface.

41. A method according to claim 40, wherein:

each pixel element includes

at least one first channel injector terminal formed from a metal layer deposited on said at least one first-type ion implant, and

second channel injector terminals formed from a metal layer deposited on said second-type ion implants.

42. A method according to claim 41, wherein:

each pixel element includes

an anode and cathode formed such that said first-type modulation doped quantum well interface and said second-type modulation doped quantum well interface are disposed between said anode and said cathode,

an anode terminal electrically coupled to said anode, and

a cathode terminal electrically coupled to said cathode to thereby integrally forming a thyristor-based pixel element on said substrate.

43. A method according to claim 42, further comprising:

emptying free charge from said second-type modulation doped quantum well interface for said given pixel element in a pixel setup mode.

44. A method according to claim 42, wherein:

said second-type modulation doped quantum well interface for each pixel element includes a potential barrier portion and a charge storage portion, said charge storage portion formed via a threshold-adjusting ion implant therein, said potential barrier portion disposed under said anode terminal and providing a voltage-controlled potential barrier.

45. A method according to claim 44, further comprising:

applying clock pulses to said anode terminals to transfer charge between adjacent pixel elements utilizing voltage-controlled adjustment of said potential barrier provided by said potential barrier portion of said pixel elements.

46. A method according to claim 42, further comprising:

emptying free charge from said first-type modulation doped quantum well interface for said given pixel element in a signal transfer mode.

47. A method according to claim 42, further comprising:

selectively coupling said cathode terminal to a load element during a signal integration mode whereby charge is accumulated in said second-type modulation doped quantum well interface for the given pixel element.

48. A method according to claim 42, further comprising:

placing said cathode terminal for the given pixel element in a high-impedance state during at least one of

a pixel setup mode whereby charge is emptied from said second-type modulation doped quantum well interface for the given pixel element, and

a signal transfer mode whereby charge is read out from said second-type modulation doped quantum well interface for the given pixel element.

49. A method according to claim 27, wherein:

said plurality of pixel elements are part of a full-frame-type imaging array.

50. A method according to claim 27, wherein:

said plurality of pixel elements are part of an interline-type imaging array.

51. A method according to claim 27, wherein:

said plurality of pixel elements are part of an active-pixel-type imaging array.